

## PREVENTING AND TREATING DEHYDRATION IN THE ELDERLY DURING PERIODS OF ILLNESS AND WARM WEATHER

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**Abstract:** *Objective:* Translate the available knowledge on ageing and dehydration into main messages for clinical practice. *Main points:* Older people are more susceptible to dehydration than younger people. This is partly due to lack of thirst sensation and changes in the water and sodium balance that naturally occur as people age. It is also, to some degree, attributable to the fact that elderly people, both those living at home and those living in institutions, often have various impairments, disabilities and/or handicaps (comorbidity). They also tend to use numerous drugs and medication for these illnesses (polypharmacy). Multimorbidity and polypharmacy often overstress the normal age-related physiological changes in the water and sodium balance and therefore increase elderly people's risk of dehydration, especially during intercurrent infections or warm weather. Elderly people, whether they are living on their own or in an institution, and especially elderly people that can no longer take care of themselves because of cognitive, sensory, motor and/or ADL impairments, need extra help to stay hydrated. The most important strategy is simply a matter of ensuring that elderly people consume a sufficient amount of fluids (at least 1.7 liters every 24 hours). Additional strategies include making healthy drinks and water easily available and accessible at all times and reminding and encouraging the elderly to consume these fluids. Elderly people should not be encouraged to consume large amounts of fluids at once but rather small amounts throughout the day. When the recommended fluid intake cannot, for whatever reason, be realized, fluids can be administered via catheter or by hypodermoclysis. In more specific and severe cases, fluids can be administered intravenously. *Conclusion:* The prevention, signaling and treatment of dehydration in the elderly is an important multidisciplinary endeavor. Formal and informal care providers need to continuously be aware of the risk factors and signs of dehydration in the elderly, especially during periods of very warm weather and when older people are ill. Standard professional care for high risk patients is imperative.

### Introduction

Water is imperative to life. It is one of the most important nutrients for the body. In fact, the human body is, in young adults, comprised of about 60% water. However, as people age, this water percentage decreases and body fat increases. While body fat contains virtually no water, metabolically active fat free body mass (organs and muscles) is made up of more than 70% water.

Water fulfils various functions in the body. Firstly, it is a transport medium for other nutrients and waste products. Secondly, it plays a role in the regulation of body temperature and in the maintenance of tissue structures. Thirdly, it supports numerous cell-level functions, including brain function (1-3). Evidently, disturbances in the body's water balance can lead to impairments in the body's functioning.

Under normal circumstances, the body ensures sufficient hydration and a good water balance (homeostasis) by regulating fluid intake and excretion. This paper does not go into further detail on these processes.

Because of physiological changes, elderly people are more likely to suffer from dehydration. These physiological changes and the vulnerability that accompanies them can also be exacerbated by a variety of diseases and high levels of medication use, both of which are common in elderly people.

Every year, a substantial number of elderly people are

admitted to hospitals in a dehydrated state. In some cases, dehydration is actually the primary reason for hospitalization (2,4). Furthermore, dehydration is one of the most common indications for moving an elderly person from a nursing home to a hospital. In fact, it has been reported that one quarter of all nursing home patients that are admitted to hospital is dehydrated (5). During periods of warm weather and heat waves, the number of dehydrated elderly people increases substantially. Failing adequate treatment, and depending on the co-morbidity, mortality rates of dehydration can reach up to 50% (6).

Clearly, frail elderly people need to be supported and encouraged to maintain normal levels of hydration. Additionally, dehydration must be diagnosed and treated as quickly as possible, especially when illness or warm weather are present.

In this article, the following topics will be briefly discussed in the context of their practical relevance:

1. Physiological changes in the water balance caused by aging;
2. The consequences of dehydration;
3. Risk factors for dehydration in elderly people that result from impairments, disabilities and handicaps, as well as from the use of medication;
4. Diagnosing dehydration in the elderly; and
5. Preventing and treating dehydration in the elderly.

This article will conclude with the main messages for medical practice.

### **Physiological changes in the water balance due to aging**

Homeostasis is the regulation of an internal environment so as to maintain a stable and relatively constant state. Homeostatic mechanisms enable the body to maintain the stability of numerous processes, including body temperature, blood salinity, and blood pressure. This stability is maintained even as conditions change. Of relevance is the fact that homeostasis plays an important role in the body's water balance, which is directly related to the salinity of the blood.

As people age, physiological changes occur and these make the body less able to maintain homeostasis. This affects not only the water balance but also thermoregulation and other systems that strive for physiological balance.

Relevant changes that make the elderly more susceptible to dehydration include: (4, 7, 8, 9)

- Decreased total body water (the older one is, the less water one stores);
- Decreased sense of thirst (whereby dehydration is not felt as quickly), which leads to less fluid consumption; this is an extension of the age-related decrease in appetite (anorexia of aging); The reduced thirst sensation is probably caused by altered awareness of dryness of mucous membranes and by decreased sensitivity to hormonal changes and increased osmolality. Some authors also suggest that endogenous opioids may be involved in this crucial change in water conservation.
- Decreased kidney function (ability to retain water and sodium), which is caused by a lower glomerular filtration rate, low renine and aldosterone levels and/or the kidney's decreased sensitivity to antidiuretic hormone.

Not only do these factors contribute to dehydration, they can also, together with a decreased heart function, increase one's chances of overhydration because the same mechanisms decrease sensitivity to overhydration and free water clearance. This too is important, especially in the context of determining the best course of treatment (rehydration therapy) in an elderly person suffering from dehydration.

In general, we know little about how changes in the various water compartments impact water levels in individual organs and tissues. A high level of interpersonal variability has been found (4, 10).

Both the above mentioned physiological changes and age-related changes in skin turgor hamper the identification of classical dehydration symptoms in the elderly. This, in turn, can delay diagnosis and make it difficult to determine the severity of the dehydration. Prevention of dehydration is therefore essential (1).

### **The consequences of dehydration**

As mentioned earlier, dehydration is common among elderly people in hospitals and other health care institutions such as nursing homes and homes for the elderly. Dehydration is also common among elderly people living at home.

Dehydration often interferes with cognitive and mental functioning. In fact, people suffering from dehydration are often found in an acute state of increased confusion, also called delirium. Dehydration is a relevant concomitant disorder that complicates the treatment of many other illnesses. In particular, dehydration increases the likelihood of thrombo-embolic complications, urinary tract infections, pulmonary infections, kidney stones, hyperthermia, constipation and orthostatic hypotension (7, 11-13).

Three kinds of dehydration can be distinguished, i.e., hypertonic dehydration, isotonic dehydration and hypotonic dehydration. In hypertonic dehydration, water loss exceeds sodium loss. This is quite common in elderly people with infections and during periods of warm weather. In isotonic dehydration, water loss is equal to sodium loss. This may be caused by vomiting or diarrhea. Lastly, in hypotonic dehydration, sodium loss exceeds water loss. This may be caused by the use of diuretics. The specific relationships between these three forms of dehydration and the above mentioned consequences are still unclear. Nonetheless, distinguishing between dehydration with and without sodium loss is important because it will shed light on the contributing factors and will lead to the best therapy. This will be discussed further in the section on diagnosing dehydration.

### **Risk factors for dehydration in the elderly resulting from impairments, disabilities and handicaps as well as the impact of medication**

In addition to age-related physiological changes in the body, numerous other factors can increase elderly people's risk of dehydration. The scientific literature on this topic discusses numerous risk factors (1-5). They are summarized in the table below.

Evidently, this table shows that dehydration can be caused by numerous factors, including illness-related factors, factors that are not directly related to disease, and factors that are clearly associated with old age. Additionally, it is also clear that the typical geriatric profile (multimorbidity, polypharmacy, frailty) and various other medical problems can lead to either a lack of sufficient fluid intake (i.e. neurological, psychiatric, cardiopulmonary and locomotor impairments) or to an increased loss of fluids (i.e. gastrointestinal problems, incontinence, pressure sores, diabetes mellitus and insipid diabetes).

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**Tabel 1**  
 Risk factors for dehydration in the elderly

1. Not illness-related:	-age > 80 -physiological changes in the water balance -fragility -previous state of dehydration
2. Illness-related:	
General:	-suffers from > 4 illnesses (comorbidity) -infections -pain and fever -wounds (incl. pressure sores) -blood loss
Neurological:	-motor and ADL / IADL disabilities -extrapyramidal diseases with tremors and excessive salivation -dementia -sensory and communicative disabilities
Psychiatric:	-depression -anxiety -delirium -psychosis / schizophrenia
Cardiopulmonary:	-dyspnea -reduced excersize tolerance
Locomotor:	-mobility impairments
Gastrointestinal:	-swallowing impairments -anorexia -vomiting -diarrhea
Uropoetic:	-incontinence and fear of incontinence -diminished kidney function
Metabolical/Endocrinal:	-undernourishment -state of hypercalcemia -diabetes mellitus -diabetes insipidus
3. Iatrogenic:	-polypharmacy (especially relevant for diuretics, laxatives, anticholinergics or psychotropic drugs) -water / sodium-related disabilities -high protein intake
4. Social:	-social isolation -self-neglect -poor or insufficient access to fluids -insufficient professional or lay care at home -institutionalization; lack of personnel or lack of properly trained personnel
5. Environmental/climate:	-winter (higher likelihood of infections) -summer (heat waves)

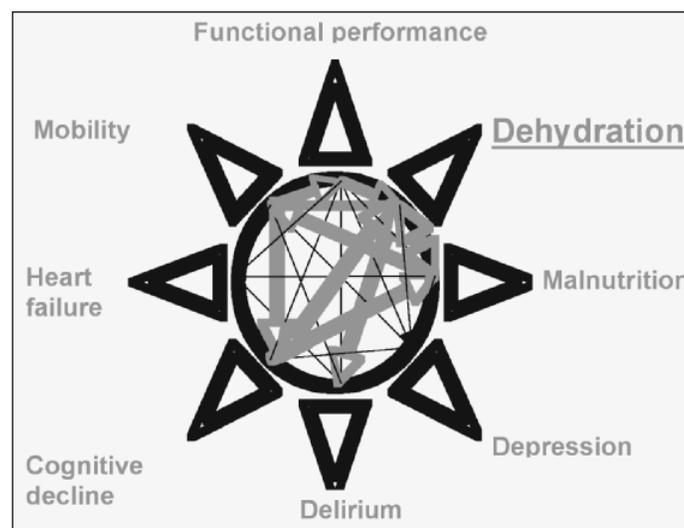
Dehydration may also be caused by the iatrogenic actions of health professionals as well as social factors such as social isolation, self-neglect and a lack of supportive care at home. Even elderly people living in nursing homes or homes for the elderly can become dehydrated either because of their own impairments, disabilities and/or handicaps or because of a lack of personnel that is able to recognize the early signs of

dehydration, provide fluids and food in a timely matter, and encourage residents to maintain a sufficient fluid intake. Additionally, interventions that limit the patient's personal freedom (i.e. the use of restraints), and thereby increase a patient's dependence on medical staff, can also lead to dehydration. Lastly, climate factors and the environment can influence the risk of dehydration. In winter, common infections like influenza can contribute to the incidence of dehydration. In summer, long periods of warm weather and heat waves obviously increase the risk of dehydration.

In most elderly people, dehydration is caused by a combination of the abovementioned risk factors, which also have complex interactions (see figure 1). As a result, dehydration can best be considered a geriatric syndrome.

**Figure 1**

Complex interactions between risk factors causing dehydration



**Diagnosing dehydration in the elderly**

The timely recognition of dehydration in the elderly is essential. Unfortunately, diagnosing dehydration in this population is not always easy.

Symptoms of dehydration in the elderly that are easy to recognize include a low attention span, low blood pressure, and dryness of the tongue and mucous membranes (which can, in turn, cause the patient to choke and/or make the patient difficult to understand). The clinical signs and symptoms of mild dehydration are often more difficult to recognize and may even be absent. Classical dehydration symptoms such as diminished skin turgor, increased thirst, oliguria, low blood pressure and orthostatic hypotension are less sensitive and less specific in elderly people. However, when an elderly person complains of a substantial decrease in urinary volume and thirst, this is likely indicative of severe dehydration. At the same time, orthostatic hypotension is common among elderly people, even in the absence of dehydration. Thus, diagnosing dehydration in elderly people is difficult. Symptoms most common in this

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population tend to be atypical and unclear. They include lethargy, confusion, constipation, fever with no obvious cause, dizziness and falls (2, 4).

Medical history and environmental factors indicative of dehydration include earlier episodes of dehydration, the presence of the previously mentioned non specific symptoms, (comorbid) illnesses and their related risks (i.e. medication use), intercurrent infections (i.e. frequent urinary tract infections resulting from irritation in the bladder's mucous membranes, which is often attributable to concentrated urine), changes in dietary habits, possible (increased) social vulnerability and climate-related factors such as heat waves.

Given that the signs and symptoms are often unclear, physical examination of an elderly patient in whom dehydration is suspected, is also difficult. However, significant weight loss within a short period of time is considered a valuable indication of dehydration. When an acute weight loss of more than 3% of the patient's body weight or more than one kilogram per day is observed, dehydration is a likely diagnosis. Frequently weighing a patient is, in fact, the most effective method for monitoring changes in the water balance (both in cases of dehydration and hyperhydration) (4, 15).

Decreased skin turgor can also be caused by dehydration. However, it is difficult to distinguish between decreased skin turgor caused by dehydration and age-related decreases in skin elasticity. Dry mucous membranes in the mouth are also indicative of dehydration but are, unfortunately, in elderly people, not specific to dehydration. Xerostomia and the use of anticholinergic drugs, both common in elderly people, may also cause dry mucous membranes in the mouth. However, a dry tongue and the presence of a lengthwise groove in the tongue are fairly sensitive signs of dehydration. Nonetheless, their

diagnostic value remains moderate (4).

Normal cardiovascular reactions to dehydration such as orthostatic hypotension and tachycardia do occur in the elderly but are, unfortunately, not very helpful in the diagnosis of dehydration because they tend to be unpredictable and because these reactions are often related to medication use and age. Even long term bed rest can contribute to orthostatic hypotension. Furthermore, dehydration can lead to non-specific damage to the skin's integrity and to pruritus (itch), skin infections and pressure ulcers. An observable increase in urine concentration suggests dehydration. All in all, when diagnosing dehydration in elderly people, professionals seem to rely most on a constant awareness of the possible presence of dehydration. They, therefore, tend to recognize a pattern consisting of several of the previously mentioned signs of dehydration(2).

In many institutions, health care providers use water balance measurements (intake versus excretion) to determine whether a patient is suffering from dehydration. While this method can be useful, it is only useful if the measurements are conducted properly and reliably. Clearly, this is a matter of quality control. Health care providers must be provided with proper training in how these measurements should be performed. They must also agree on the intake/excretion ratio considered to be indicative of dehydration. In addition, an estimation of the non-observable water loss (due to evaporation and respiration) should be made.

When compared to water balance measurements, regular weight monitoring is likely to be a more reliable means of observing changes in a patient's water balance. During periods of increased risk, patients should be weighed more frequently (daily or every other day). Like water balance measurements, this method requires standardization and quality control. To

**Table 2**

Diagnostic clues for dehydration in the elderly with and without accompanying sodium loss derived from medical history, physical examination and laboratory tests (4, 14)

Sign or symptoms	Water loss only	Water and sodium loss
<b>HISTORY:</b>	Recent weight loss of >3 % Decreased water intake Increased water loss (fever, tachypnea, heat)	Recent weight loss of >3%. Vomiting, diarrhea, use of diuretics, bleeding
<b>PHYSICAL EXAMINATION:</b>		
Dry tongue	+	+
Lengthwise groove in tongue	+	+
Dry mucous membranes in mouth	+	+
Decreased muscle strength in upper body	+	+
Confusion	+	+
Speaking difficulties / dysarthria	+	+
Sunken eyes	+	+
Blood pressure	Normal or decreased	Significantly decreased
Pulse rate / Heart rate	Normal or increased	Significantly increased
Weight loss	> 1kg/day	> 1 kg/day
<b>LABORATORY TESTS:</b>		
Serum creatinine	Increased	Increased
Serum urea	Increased	Significantly increased
Serum sodium	Increased	Normal or decreased
Urine production	Decreased	Increased, normal or decreased

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reliably weigh an elderly person with poor mobility, time, attention and a simple protocol for standardization are essential.

Laboratory tests are often used to confirm the presence of dehydration, determine the severity of the dehydration and guide health care providers in choosing the best course of treatment. Relevant tests include the serum creatinine and urea concentrations, and the urea/creatinine ratio ( $> 0.1$ , is indicative of dehydration). Of these tests, the serum creatinine concentration appears to be the most sensitive biomarker. However, its specificity is not optimal. As a result, creatinine measurements should be performed alongside numerous other measurements. All of the above measurements are useful for elderly people that have experienced dehydration in the past and in cases where the risk factors suggest an unstable water balance (2, 16).

The importance of distinguishing between dehydration with sodium loss and dehydration without sodium loss was outlined earlier (4, 14). Table 2 below provides additional guidance on this matter.

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#### Prevention

Adequate prevention of dehydration requires awareness of the afore mentioned physiological characteristics of elderly people as well as knowledge of risk factors for dehydration relating to illness, social factors, climatic influences and medical practices. Nevertheless, elderly people, vulnerable or not, display significant variability with respect to their risk for a disturbed water balance (17, 18). Institutions can help to reduce elderly people's risk for dehydration during periods of warm weather by taking actions that support the water balance. These include offering fluids more often and weighing patients more frequently.

In addition to medical and health care related actions that focus specifically on the risk factors for dehydration, elderly people living in institutions (nursing homes) or at home should constantly be reminded that they should consume sufficient fluids, even if they do not think it is necessary because of their decreased sense of thirst.

There are major differences between the European countries in the way care for the elderly is organised. Long-term institutional care or nursing home care, for instance, shows clear differences between European countries with respect to institutionalization rates, staff qualifications and financing. Furthermore, there are indications that nursing homes in European countries differ in quality of care and this is an important aspect if we take into account patient safety associated with the support that can be provided by nurses or nurses' aids to frail elderly needing help with eating and drinking or elderly needing more specialized ways of fluid administration (19, 20).

According to the Dutch Nutrition Centre, elderly people require a minimum of 1700 ml of fluids per day (see [www.voedingscentrum.nl](http://www.voedingscentrum.nl)). Institutions should adhere to this

advice and implement a protocol with respect to this minimum fluid intake. Even patients that, because of heart failure or kidney damage, are required to decrease their fluid intake, should not receive less than the minimum amount of fluids recommended by the nutrition council. A minimum intake is equally as important as a maximum intake.

In essence, all elderly people should consume between 1.5 and 2 liters of fluids per day. If additional water loss is observed, more fluids should be consumed or administered, depending on the self-care of the patient (21). Fevers and increases in outdoor (i.e. heat waves) and/or indoor temperatures (i.e. relatively high heating in institutions) also require an increase in fluid intake. When a fever is present, an additional 500 ml of fluids per degree above 38° is recommended. Clearly, whenever acute, intercurrent risk factors are present (acute illness, heat waves, etc.), institutions should take steps to increase fluid intake, and to include fluid intake monitoring in their medical and nursing duties.

Elderly people should consume sufficient fluids during meals, as meals occur regularly and are seen as occasions where the consumption of fluids is normal. At the same time, elderly people should also consume fluids between meals. Evidently, a good distribution of fluid intake over the course of the day is advisable. This can be done by encouraging elderly people to consume fluids during regular daily activities (i.e. while brushing one's teeth or while taking one's medication).

It is also better for elderly people to drink small amounts on many occasions throughout the day rather than large amounts on only a few occasions. Drinking large amounts all at once can cause the stomach to expand which, in turn, decreases one's sense of thirst. The accessibility and availability of fluids are also important considerations. Sufficient fluids must be available and elderly people must be able to easily access these fluids.

The kinds of fluids consumed are also relevant. Mineral drinks (including bouillon), fruit juices, tomato juice, milk and sport drinks are recommended. Excessive consumption of alcoholic drinks and high protein supplements should be avoided, especially during periods of dehydration as these drinks actually dehydrate rather than hydrate.

If a patient urinates less often than normal or if the patient's urine is darker than normal, more fluids should be consumed and the patient should be checked for urine retention. Professionals should not wait until the patient says he or she is thirsty.

It is also imperative that elderly people eat healthily and regularly. Fruits and vegetables contain large amounts of water, vitamins and salt and can therefore contribute to the prevention of dehydration. Naturally, when specific problems such as swallowing difficulties are present, unique measures for preventing dehydration should be taken (i.e. consult a speech therapist and dietician, thicken drinks, etc.).

Elderly people living at home or in institutions that are highly dependent on others for care should be offered additional assistance with drinking.

Formal and informal health care providers must also pay special attention to the signs of dehydration when elderly people are acutely ill and during heat waves. This can be done by offering fluids frequently, helping elderly people to consume fluids and checking whether the fluids have actually been consumed. The elderly person's family can play a supportive role in this.

Another relevant factor is warm weather. Heat waves are increasingly prevalent not only in the summer but also in the spring and autumn. To further complicate matters, many informal care providers go on holidays in the summer. This increases the vulnerability of the elderly people left behind. Extra attention to signs of dehydration is therefore necessary. Neighbors, other family members and/or home care providers (if applicable) should be informed that the regular informal care provider is away. In this fashion, these people can keep an eye on the elderly person left alone at home. Important information (i.e. telephone numbers) should also be provided to these people so that, if the elderly person requires this information or direct assistance, it can be provided. Summer holidays also affect institutions. Many institutions are required to function with a limited number of personnel during the summer months. This too increases elderly people's risk of dehydration.

### **Treatment**

Clearly, general dehydration prevention for the elderly and specific measures that are tailored to individual risk factors (see table 1) in vulnerable elderly people are essential. However, sometimes these measures are not enough to prevent dehydration. As a result, timely and adequate attention to (vulnerable) elderly people who nonetheless are likely to dehydrate or who already manifest symptoms of dehydration is imperative. When patients suffer from illnesses that increase their risk of dehydration (table 1), specific kinds of medical and nursing care are required. For example, when an illness that increases the risk of dehydration intermittently worsens or when extra illness-related problems (i.e. fever) occur, health professionals may need to 'prescribe' fluids. Dependent on the severity of the dehydration, it may also be necessary to monitor fluid intake, weight and the vital body functions such as blood pressure, pulse, temperature, and urine production.

Additionally, fragile elderly people who present with one or more of the risk factors mentioned earlier will likely require the help of informal and/or formal care providers to create enough opportunities to consume fluids and to ensure sufficient actual fluid intake.

Monitoring elderly people's water balance (including urine production) is not easy, especially when the person in question has limited mobility and/or suffers from incontinence. It is nonetheless important and necessary to do so when hypotension is present. Weighing the patient is likely the most feasible method for monitoring water balance. Weight, fluid intake and, if necessary, serum sodium and serum creatinine levels should be used to determine the course of treatment. Water loss estimation formulas are not very useful in clinical practice, as

they have not yet been validated for the elderly population.

Severe hypertonic and hypotonic dehydration (severe water and salt loss, respectively; see table 2) can result in a loss of consciousness. In general, this always leads to hospitalization. Hospitalization is also common when very high or very low serum sodium levels are found (i.e. higher than 155 mmol/l or lower than 125 mmol/l), even when the water balance does not appear to be disturbed. A timely restoration of the water balance demands specialized knowledge regarding the amount of fluids that should be administered and the timing of the fluid administration.

When dehydration occurs in the final phases of life, professionals together should decide, best in a multidisciplinary team meeting, on the preferred actions. Most often, dehydration in terminally ill patients occurs without many symptoms. Rehydration for palliative or symptomatic reasons is, therefore, in most cases, unnecessary.

### *Selection criteria for fluid administration*

When a state of dehydration is observed, health professionals should determine: a) the patient's fluid shortage (by monitoring body weight); b) how quickly the dehydration developed; and c) whether or not the patient suffers from only water loss or both water and salt loss. Based on this, appropriate rehydration therapy should be applied and monitored, at least during the most vulnerable phases of dehydration, by frequently weighing the patient and by ordering appropriate laboratory tests (serum sodium and serum creatinine) on a regular basis.

The time in which body fluids should be restored is dependent on how quickly the fluid shortage developed and also on the severity of the clinical symptoms. Fluid shortages that occur over long periods of time require a slow repletion rate, in order not to further disturb the internal milieu (the so-called homeostasis). When dehydration occurs quickly or is accompanied by severe clinical symptoms (i.e. hypotension, delirium), the repletion of fluids should occur quickly (within 24 hours). In the latter situation, hospitalization or at least 24-hour nursing surveillance is necessary.

### *Rehydration Therapy*

When determining the most appropriate course of treatment and rehydration therapy, special attention should be paid to the composition of the preferred fluid supplement. The osmolar excretory burden and the water percentage of the supplement are important. In terms of compliance, it is also important that the taste and the consistency of the supplement be considered. Composition is also relevant when the patient has difficulties swallowing.

Additionally, attention should be paid to the way in which the fluids are administered and the degree to which this fits to the patient's clinical state. Fluids can be administered orally, enterally, subcutaneously or intravenously. Whenever possible, oral fluid repletion is preferred. Oral administration is appropriate in the absence of severe symptoms and when the

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situation allows for it, i.e., if fluids can be restored gradually over time. Fluid administration via a nasogastric feeding tube is advisable when the oral fluid intake is insufficient and also when the patient is not consuming sufficient nutrients. Naturally, when choosing to administer fluids via tube feeding, the health professional must consider: a) the potential side effects such as aspiration and diarrhea (that can in turn lead to greater dehydration); and b) the ethical issues that play a role in administering fluids and nutrients by tube to patients with severe chronic illnesses such as dementia. Intravenous therapy is commonly used when the dehydration is severe and when the clinical state of the patient demands an acute intervention. This kind of therapy should only be prescribed by medical professionals who can weigh the possible risks and complications against the benefits. An alternative, and often undervalued, technique for administering fluids is hypodermoclysis. In hypodermoclysis, fluids are administered via one or two subcutaneous infusions. This evidenced-based and cost effective geriatric therapy with few side effects can increase a patient's fluid volume by approximately 3 liters per 24 hours (22, 23). Because hypodermoclysis is easy to administer, it can be effectively used not only in elderly people living in nursing homes or homes for the elderly, but also in elderly people living at home. This is very important if we take into account the earlier mentioned differences in possibilities of care in these settings and the possible / common lack of knowledge and skills in personnel of nursing homes or residential care settings to provide fluid administration via nasogastric tube feeding or intravenous rehydration therapy.

With hypodermoclysis, (unnecessary) hospitalization often can be avoided and frail elderly may benefit most from this type of treatment.

### **BOX Rehydration therapy**

For example a 75 year old patient with 39 degrees body temperature and dehydration by a loss of 2 litres of pure water, should receive 2,2 L water in order not to dehydrate further, and in addition should receive at least 1 L of water daily to get rehydrated in two or three days.

### **Concluding statements**

Dehydration is the most common fluid and electrolyte disorder in elderly people. When left untreated, dehydration shows high mortality rates.

Elderly people are susceptible to dehydration not only because of age-related physiological changes, but also because of the presence of illness-related, iatrogenic, social and environmental risk factors.

In elderly people that are dependent on others for activities of daily living, fluid intake and water balance should be monitored closely, especially when circumstances increase their risk of dehydration (i.e. during heat waves and when the person in question has a fever).

Diagnosing dehydration in the elderly is often difficult. Most symptoms, such as acute significant weight loss, decreased skin

turgor, reduced diuresis, and a dry mouth are indicative of, but not specific for dehydration. However, a dry tongue and lengthwise grooves in the tongue are relatively sensitive signs of dehydration. Nonetheless, their diagnostic value remains moderate.

Laboratory tests are often used to confirm the presence of dehydration, show the severity of the dehydration and guide health care providers in choosing the best treatment. The serum creatinine concentration is the most sensitive laboratory test. It can be used to monitor kidney function and the body's water balance. The serum sodium concentration can be used to determine the cause of the patient's fluid shortage (hypertonic, isotonic or hypotonic). These tests should be performed regularly in patients who are suffering from dehydration or who have a history of dehydration.

Preventive measures include ensuring that all elderly people have a minimum fluid intake of at least 1.7 liters per 24 hours (in accordance with the Dutch Nutritional Council's recommendations). In order to meet this minimum, elderly people should be encouraged to consume fluids both during and between meals. They might also be encouraged to consume fluids during regular daily activities such as brushing one's teeth and taking one's medication. Elderly people should be encouraged to drink small amounts of water throughout the day rather than large amounts on only a few occasions. Water and other fluids such as mineral drinks (including clear soup), fruit juices, tomato juice, milk and sport drinks should also be made available and easily accessible. When elderly people are dependent on others for care, the provision of additional assistance with drinking is recommended.

During periods of acute illness (i.e. infections with accompanying fever) and during periods of warm weather (i.e. heat waves), formal and informal care providers should pay extra attention to the fluid intake of the elderly person in question. They should also monitor his or her water balance.

Elderly people with severe dehydration (severe water loss) and/or a severe salt balance disturbance should be hospitalized. In all cases, when a state of dehydration is observed, it is important to determine the fluid shortage, how quickly the dehydration has developed and whether or not the patient suffers from only water loss or both water and salt loss. Based on this, appropriate rehydration therapy should be applied and monitored.

In rehydration therapy, fluids can be administered orally, enterally, subcutaneously or intravenously. Whenever possible, oral fluid repletion is preferred. When oral fluid intake is insufficient, fluids can be administered via a feeding tube or by hypodermoclysis, which is a generally undervalued alternative technique. In more specific and severe cases (decline of consciousness and high or low sodium levels), fluids need to be administered intravenously.

When dehydration occurs in terminally ill patients, a multidisciplinary team should determine the best course of action. In most cases, rehydration therapy is not needed in case

of strict palliative treatment objectives.

This paper is an English version of a guideline prepared on request of the Dutch Ministry of Health for which only the authors bear responsibility. To pay more attention to the problem of dehydration in the elderly, the specific content of this paper will be used in the revision process of current, but already older nutritional guidelines.

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